

What is claimed is:

1. A nanocomposite electrolyte membrane for a fuel cell, comprising:  
a polymer having cation exchange groups; and  
silicate nanoparticles dispersed in the polymer, the silicate nanoparticles  
5 having a layered structure, and the silicate nanoparticles being intercalated with the  
polymer, or layers of the silicate nanoparticles being exfoliated.

2. The nanocomposite electrolyte membrane of claim 1, wherein the  
silicate is selected from the group consisting of smectite, vermiculite, halloysite,  
10 sericite, mica, and a mixture of the forgoing materials.

3. The nanocomposite electrolyte membrane of claim 2, wherein the  
smectite is selected from the group consisting of montmorillonite, saponite, beidellite,  
nontronite, hectorite, stevensite, and a mixture of the forgoing materials.

4. The nanocomposite electrolyte membrane of claim 1, wherein the  
silicate nanoparticles have an average diameter of 1-100 nm.

5. The nanocomposite electrolyte membrane of claim 1, wherein the  
20 amount of the silicate nanoparticles is in a range of 1-30% based on the total weight  
of the nanocomposite electrolyte membrane.

6. The nanocomposite electrolyte membrane of claim 1, wherein the  
cation exchange groups of the polymer are selected from the group consisting of a  
25 sulfonate acid group, a carboxyl group, a phosphoric acid group, an imide group, a  
sulfonimide group, a sulfonamide group, and a hydroxyl group.

7. The nanocomposite electrolyte membrane of claim 1, wherein the  
polymer with cation exchange groups is a homopolymer or a copolymer of  
30 trifluoroethylenes, tetrafluoroethylenes, styrene-divinyl benzenes,  $\alpha$ ,  $\beta$ ,  $\beta$ -  
trifluorostyrenes, styrenes, imides, sulfones, phosphazenes, etherether ketones,  
ethylene oxides, polyphenylene sulfides, or aromatic groups, or a derivative of the  
homopolymers and the copolymers, or a mixture of the forgoing materials.

8. The nanocomposite electrolyte membrane of claim 1, wherein the polymer is a highly fluorinated polymer with sulfonate groups as proton exchange groups at the terminals of side chains and containing fluorine atoms that amount to at least 90% of the total number of fluorine and hydrogen atoms bound to carbon atoms of the backbone and side chains of the polymer.

9. The nanocomposite electrolyte membrane of claim 1, having a thickness of 30-200  $\mu$  m.

10. A fuel cell comprising:  
a cathode where a reduction of an oxidizing agent occurs;  
an anode where an oxidation of fuel occurs; and  
the nanocomposite electrolyte membrane according to any one of claims 1 through 9 interposed between the cathode and the anode.

11. The fuel cell of claim 10, wherein the cathode comprises a catalyst layer containing carbon supported platinum catalyst.

12. The fuel cell of claim 10, wherein the anode comprises a catalyst layer containing carbon supported platinum catalyst.

13. The fuel cell of claim 10, wherein the anode comprises a catalyst layer containing carbon supported platinum-ruthenium catalyst.